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Remarks

Applicant and his representatives wish to thank Examiner Berezny for the thorough examination of the present application and the detailed explanations in the Office Actions dated December 15, 2004 ("OA1") and June 1, 2005 ("OA2"). The Examiner's concerns have been given serious consideration, but we believe that the present claims should be allowed over the cited references.

The present invention relates to a method for fabricating a metal line of a semiconductor device. The method generally forms a plurality of metal lines by (1) forming a metal layer, (2) forming a photoresist on the metal layer, such that the photoresist has openings of a certain width, (3) forming a buffer layer on the photoresist pattern, including in the opening, and (4) selectively removing the metal layer at a lower side of the opening by dry etching. (See Claim 1 as amended on March 11, 2005.)

The references cited against the claims (Narita et al, U.S. Pat. No. 6,383,942 [hereinafter "Narita"], Hart et al., U.S. Pub. No. 2003/0034325 [hereinafter "Hart"], and Yu, U.S. Pat. No. 6,764,957 [hereinafter "Yu"]) neither disclose nor suggest forming a buffer layer on a photoresist and in an opening in the photoresist to form metal lines.

There must be some reason, suggestion, or motivation found in the prior art whereby a person of ordinary skill in the field of the invention would make a claimed combination. That knowledge cannot come from the applicant's invention itself. *In re Oetiker*, 977 F.2d 1443, 1447; 24 U.S.P.Q.2d 1443 (Fed. Cir. 1992); citing *Diversitech Corp. v. Century Steps, Inc.*, 850 F.2d 675, 678-79, 7 USPQ2d 1315, 1318 (Fed. Cir. 1988); *In re Geiger*, 815 F.2d 686, 687, 2 USPQ2d 1276, 1278 (Fed. Cir. 1987); *Interconnect Planning Corp. v. Feil*, 774 F.2d 1132, 1147, 227 U.S.P.Q. 543, 551 (Fed. Cir. 1985). In this case, Narita does not even disclose forming a buffer layer over a photoresist, much less provide any reason, suggestion or motivation to protect a device from mechanical damage as disclosed by Hart, nor does Hart provide any reason, suggestion or motivation to form a buffer layer over a photoresist in a method including dry etching a metal layer in a semiconductor device. Thus, the cited references fail to provide any

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reason, suggestion, or motivation by which a person of ordinary skill in the field of the invention would make the combination of forming a buffer layer on a photoresist pattern, including in the opening of the photoresist pattern, and selectively removing the metal layer at a lower side of the opening by dry etching, as presently claimed. Therefore, this ground of rejection is legally unsustainable, and should be withdrawn.

To assert that one of ordinary skill in the art would understand the benefits of the invention as a result of modifying the disclosures of the cited references in the manner necessary to arrive at the invention, without any suggestion in the references to do so, is a classic hindsight reconstruction of the invention. One cannot use hindsight reconstruction to pick and choose among isolated disclosures in the cited references to deprecate the claimed invention. *In re Fine*, 837 F.2d 1071, 1075, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988); see also *In re Pleudemann*, 910 F.2d 823, 828, 15 U.S.P.Q.2d 1738, 1742 (Fed. Cir. 1990); and *Uniroyal, Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 1051, 5 U.S.P.Q.2d 1434, 1438 (Fed. Cir. 1988). To use the patent [application] as a guide through the cited references, combining the right disclosures in the right way (in this case, in an unrelated way) to arrive at the result of the claimed invention, is improper. See, e.g., *Medtronic, Inc. v. Daig Corp.*, 611 F. Supp. 1498, 1534, 227 U.S.P.Q. 509, 535 (D. Minn. 1985), *aff'd* 789 F.2d 903, 229 U.S.P.Q. 664 (Fed. Cir. 1986).

The Rejections of the Claims under 35 U.S.C. § 103(a)

The rejections of Claims 1-3, 11-18, and 20, and separately, of Claims 4-10 and 19 under 35 U.S.C. § 103(a) as being unpatentable over Narita, Hart and Yu are respectfully traversed.

As the Examiner has correctly recognized, even if Narita and Hart can be combined, they do not disclose the limitations of the present claimed invention. The Examiner notes that Narita and Hart are silent as to the dimension between adjacent metal lines versus the opening width (OA2, page 3, lines 7-8). Furthermore, as stated previously in the Amendment filed March 11, 2005, one skilled in the art is not likely to combine Hart and Narita to form the present invention. Hart is directed to providing mechanical protection for semiconductor components in an inkjet

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print head, whereas Narita is directed to a method of etching metal lines in a semiconductor device.

The *Prima Facie* Case for Obviousness (MPEP § 2142)

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Also, the reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination must be found in the prior art, and not based on applicant's disclosure. *In re Vaack*, 947 F.2d 488 (Fed. Cir. 1991).

The Combination of Narita and Hart

The Examiner has failed to establish a *prima facie* case for obviousness with respect to the combination of Narita and Hart. The Examiner's duty is to provide evidence of a suggestion or motivation to combine in the references themselves or in the knowledge generally available to one skilled in the art. *Id.* In establishing such a suggestion or motivation, "broad conclusory statements standing alone are not 'evidence'". *In re Kotzab*, 217 F.3d 1365, 1370 (Fed. Cir. 2000). The Examiner states that "it would have been obvious to a person of ordinary skill in the art at the time of invention to use the buffer layer of Hart with the method of Narita to protect the device from mechanical damage." (See OA2, page 3, lines 5-7.) There is no evidence on the record to support an assertion that risk of mechanical damage is an issue in a method of forming metal lines in a semiconductor device. Thus, the Examiner's conclusory statement does not establish the existence of a motivation to combine. Therefore, the Examiner has failed to provide evidence of any motivation or suggestion to combine Narita and Hart, and thus, has not stated a *prima facie* case for obviousness.

The references themselves do not disclose any motivation to prevent mechanical damage in a process for selectively removing metal by dry etching to form metal lines. The method of Narita relates to a dry etching method capable of patterning a stacked film such that the thin film

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is formed vertically and the metal film is prevented from being side-etched (col. 2, ll. 47-53) and/or reducing a pattern transfer difference (col. 3, ll. 1-4). As the Examiner correctly recognizes, Narita does not disclose forming a buffer layer as claimed (see, e.g., OA1, page 3, lines 6-7).

Hart discloses an improved method for grit blasting slots in a silicon wafer, including providing a silicon wafer, applying a non-water soluble layer to a surface of the wafer to provide a first substantially permanent layer thereon, applying a water-soluble protective material to the first layer to provide a second layer, grit blasting slots in the wafer corresponding to the individual semiconductor components, and subsequently, removing the water-soluble protective layer from the wafer. The protective layer provides enhanced protection for the electrical components on a silicon wafer during grit blasting so that a higher yield of useable semiconductor chips may be made. (See, e.g., Hart Abstract.) Hart is silent with regard to a metal layer, much less selectively removing a metal layer at a lower side of an opening in an overlying photoresist layer to form metal lines.

Hart discloses a need to prevent mechanical damage due to "grit passing through the wafer [that] may ricochet and impinge on the active surface side of the wafer thereby causing electrical shorts and open circuits." (See, e.g., Hart Abstract.) Grit passing through a wafer is clearly not a problem contemplated by Narita, nor is any resulting mechanical damage, because grit blasting is not part of the process of dry etching (or selectively removing part of) a metal film. Therefore the references themselves do not disclose a suggestion or motivation to combine Narita with Hart for the purpose of preventing mechanical damage in a process for dry etching metal lines.

However, even if one assumes for the sake of argument that such disclosures from the cited references can be combined, the cited references have no appreciation of the advantages of doing so. For example, a problem in the art (a random metal bridge phenomenon) can occur due to a decrease in photo margin as the photoresist pattern becomes thicker. In contrast, when the photoresist pattern becomes thinner (e.g. to increase the photo margin), a notching phenomenon may occur due to insufficient photo margin. (See, e.g., paragraph [0012] of the present

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application.) The present invention advantageously improves a photo margin in a photo process, thereby improving device characteristics and device yield. (See, e.g., paragraph [0033] of the present application.) The Examiner's cited references do not appear to disclose or suggest any such improvement.

If Narita and Hart cannot be combined, then Yu cannot cure the deficiencies of these references with respect to Claim 1. Because there is no reasonable motivation or suggestion to combine these references, the rejection of Claim 1 under 35 U.S.C. §103(a) is improper. Claims 2-20 all depend directly or indirectly from Claim 1, and are therefore believed to be patentable for the same reasons as Claim 1. Thus, this ground of rejection is unsustainable, and should be withdrawn.

The Combination of Narita, Hart, and Yu

Even if Narita and Hart could be combined as suggested by the Examiner, the Examiner has failed to provide evidence that there is any motivation or suggestion in the references or in the general knowledge of one skilled in the art to further combine Yu. The Examiner states that the motivation for combining Yu to Narita and Hart is that a person "would look to one such as Yu for material savings because Yu discloses wherein a ratio of said photoresist thickness to said certain width of said opening is less than about 3.5." (OA2, page 3, lines 19-21.) This assertion appears to be somewhat of a *non sequitur*, as there is no indication that a "ratio of said photoresist thickness to said certain width of said opening [of] less than about 3.5" has any relation to "material savings" without more, other than in light of the present disclosure. (See, e.g. paragraph [0033] of the present application.) Therefore the Examiner has failed to provide evidence of any motivation or suggestion to combine Narita, Hart, and Yu, and thus has not stated a *prima facie* case for obviousness.

There is no disclosure in any of the references relating to material savings, or that otherwise suggests that Narita and/or Hart may look to Yu. Yu is directed towards a process of forming metal contacts or via plugs that are narrower at the bottom than at the top. A dielectric

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layer and a patterned photoresist layer are sequentially formed on a substrate. A portion of the exposed dielectric layer is removed to form a first opening. A first liner is formed on the surfaces of the photoresist layer. An anisotropic etching process is conducted using the first liner and the photoresist layer as a mask to remove a portion of the dielectric layer under the first opening to form a second opening incorporating the first opening. A second liner is formed on the photoresist layer covering the first liner. Then, the above etching step is repeated to form a third opening that incorporates the second opening and exposes the substrate. The second liner, the first liner and the photoresist layer are removed, and then a conductive material is filled into the third opening to form a contact or via plug. (See, e.g. Yu Abstract.) Yu thus describes a process for forming successively smaller and deeper holes in a dielectric layer.

Even if Yu were combined with Narita and Hart, it would fail to cure the shortcomings of those disclosures. Yu etches successively smaller and deeper holes in dielectric materials to form holes therein, rather than etching metal to form lines therefrom. Yu could hardly be further removed from Claim 1 or the primary cited reference. Yu does not disclose the element of selectively removing the metal layer at a lower side of the opening by dry etching to form a plurality of metal lines such that a dimension between adjacent metal lines is less than said certain width of said opening, as recited in Claim 1 of the present application. Consequently, Yu does not cure the deficiencies of Narita and Hart with regard to the result recited in the present Claim 1, and Claim 1 is believed to be fully patentable over Narita, Hart, and Yu even if they could be properly combined.

Claims 2-20 all depend directly or indirectly from Claim 1, and are therefore believed to be patentable for the same reasons as Claim 1. Thus, this ground of rejection is unsustainable, and should be withdrawn.

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Conclusions

In view of the above remarks, all bases for rejection are believed to be overcome, and the application is believed to be in condition for allowance. Early notice to that effect is earnestly requested.

If it is deemed helpful or beneficial to the efficient prosecution of the present application, the Examiner is invited to contact Applicant's undersigned representative by telephone.

Respectfully submitted,



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